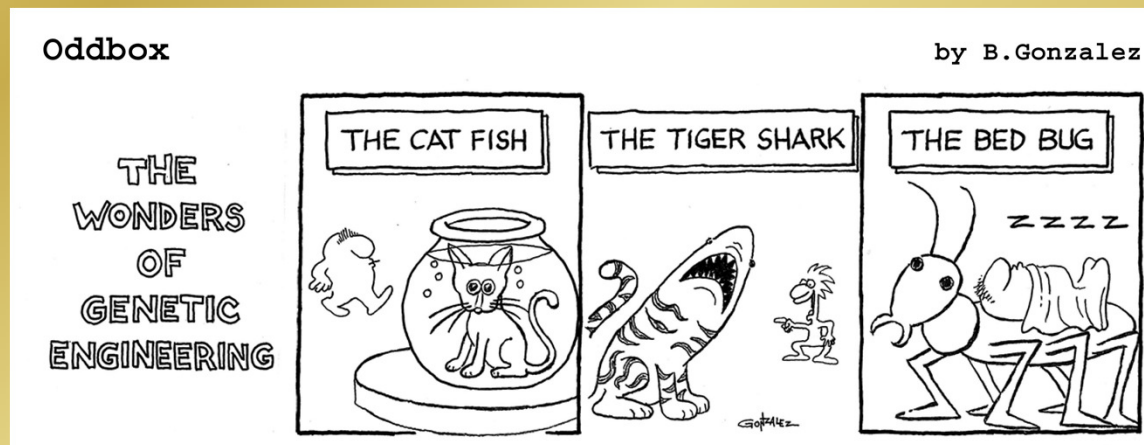


# GENETIC ENGINEERING

## Chapter 15

- **Genetic Engineering** =
  - Manipulating the genetic material to produce desirable functions that would not occur naturally



# Examples

- **Selective breeding** =

- The intentional breeding of organisms to produce offspring with certain desirable characteristics

- 2 common methods

- 1. **Hybridization** =

- Crossing dissimilar individuals to bring together the best traits of both

- Ex: Combine disease resistance with food producing capacity

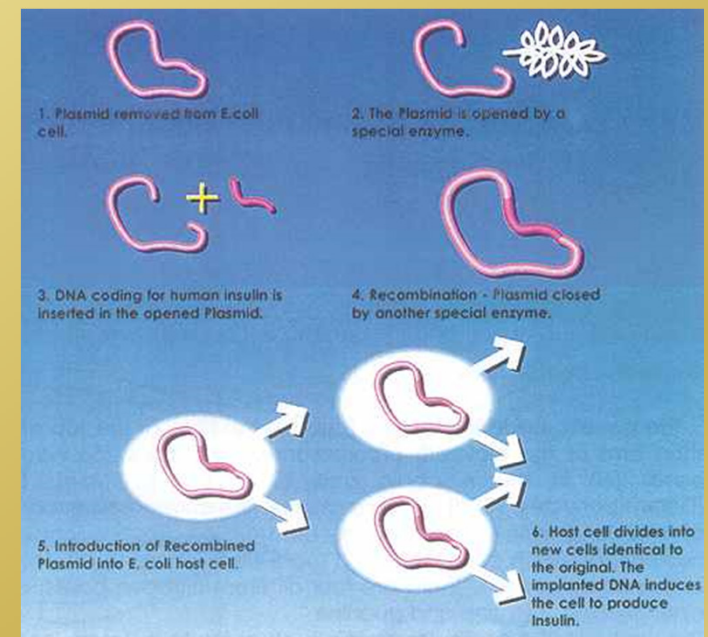
## 2. **Inbreeding** =

- Continued breeding of individuals with similar desirable characteristics
- Risk: Could increase likelihood of genetic defects

## • **Biotechnology** =

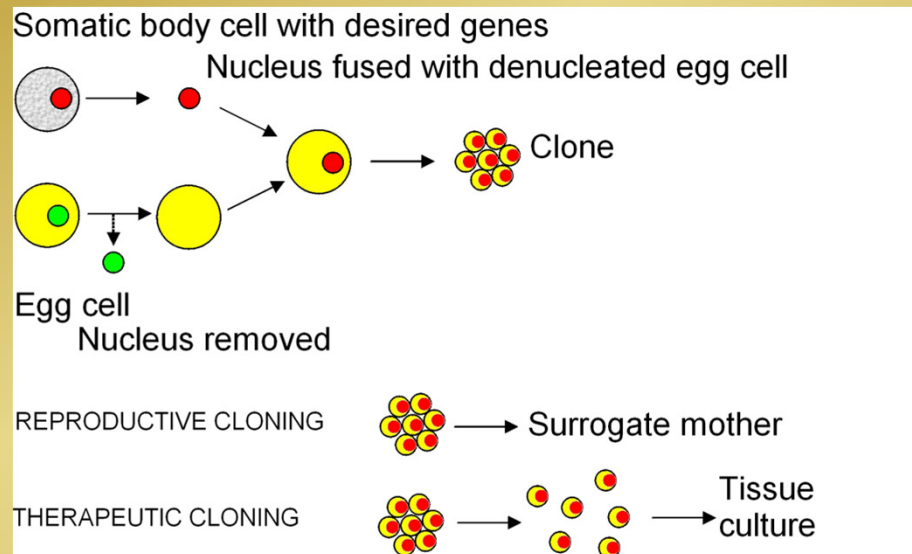
- The manipulation of living organisms to produce useful products
- Introduce mutations to increase variation

- **Recombinant DNA** =
  - DNA produced by combining DNA from different sources
  - Often use **plasmids** =
    - Small, circular piece of DNA from bacteria
  - Used to produce **transgenic organisms** =
    - Contain genes from other species



- **Cloning** =

- Uses single cell of an adult to grow a genetically identical organism
- Egg cell whose nucleus was removed is fused with a donor cell
- Resulting embryo is implanted into foster mother to develop



# Applications



# Agriculture

- GMOs could produce less expensive and more nutritious food
  - Improve crop resistance to insects, herbicides, and pathogens
  - Increase crop yields without using harmful chemicals
  - Increase milk production and produce leaner meat
- Cloning could
  - Increase food supply
  - Save endangered species

# Medicine

- Preventing disease
  - Production of vitamins, antibodies, and proteins
    - Ex: Engineer rice to contain more Vitamin A
- Treating disease
  - Using bacteria to produce insulin, human growth hormone, blood clotting factors, etc.
  - **Gene therapy** =
    - Replacing an absent or faulty gene with a normal working one
- Medical research
  - Using transgenic animals as test subjects to study progression and treatment of human diseases
- Genetic testing to diagnose diseases earlier

# Forensics

- **DNA fingerprinting** =
  - Analyzes sections of DNA that vary widely from one individual to another
  - Used to
    - Solve crimes and convict criminals
    - Overturn wrongful convictions
    - Conserve wildlife by identifying poached animals
    - Establish paternity
    - Identify remains of unknown soldiers and victims

# Pros and Cons

## Pros (+)

- Prevent, treat, and possibly cure diseases
- Reproduce human organs for transplants
- Increase crop resistance to harsh conditions, pests, and pathogens
- Improve taste and nutritional value of crops
- Lower food cost by improving crop yield
- Protect endangered species
- Could increase genetic diversity
  - IE: Hybridization, Recombinant DNA, biotechnology

## Cons (-)

- Threaten beneficial organisms
- Creation of new pathogens
- Harmful side effects, genetic defects, death
- Expensive
- Moral/Ethical concerns
- Irreversible effects with unknown consequences
- Could decrease genetic diversity
  - IE: cloning, inbreeding